# FERNALD
Closure Project

Verification Report for the Removal of Tetrachloroethene from the Remaining Portion of Contaminated Soil Obtained from the Fire Training Facility, Remediation Area 6

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1.0 INTRODUCTION

This verification report summarizes analytical data that demonstrates the enhanced soil venting carried out for the Fernald Closure Project (FCP) was successful in removing tetrachloroethene (PCE) from the remainder of contaminated soil excavated from the Area 6 Fire Training Facility (FTF), initially staged at AR3-007, and later moved to Quonset Hut No. 1 (Figure 1). Successful treatment of the PCE-contaminated soil for the portion of the pile sampled allows the treated soil to be placed in the On-Site Disposal Facility (OSDF), per the direction provided in the Sitewide Excavation Plan (DOE 1998) and the Implementation Plan for Area 6 Solid Waste Landfill and Fire Training Facility (DOE 2003).
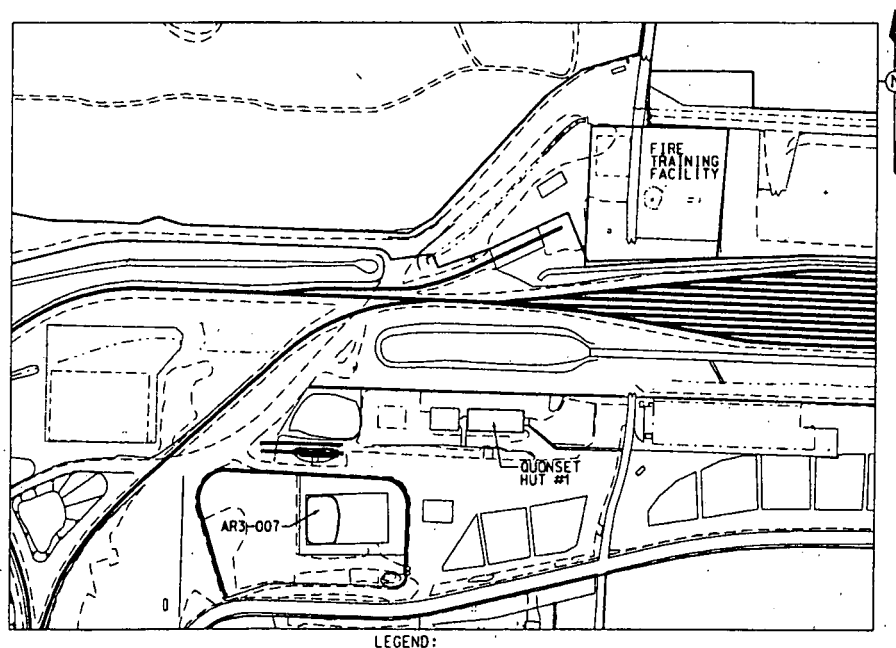
FIGURE 1 Location of Quonset Hut No. 1, the Fire Training Facility and Stockpile AR3-007

1.1 Background Information

During the RI/FS process the Fire Training Facility was identified as Hazardous Waste Management Unit (HWMU) 1 (DOE 1995). During the predesign investigation for the FTF, the soil was shown to contain PCE above the waste acceptance criteria (WAC) for the OSDF. Soil staged at Quonset Hut No. 1 is primarily comprised of brown and gray glacial deposits removed during the excavation of the FTF and initially staged at AR3-007 (Figure 1). Detailed information on the sampling history of the soil can be found in the Implementation Plan for Area 6, Solid Waste Landfill and Fire Training Facility (DOE 2003) and Variances 131 and 144 to the Project Specific Plan (PSP) for Area 3A/4A Excavation Characterization and Precertification (DOE 2002a).

2.0 TREATMENT RESULTS

Treatment of the approximately 400 yds^3 of soil began on November 18, 2003 and continued intermittently for approximately 161 days. In-line gas sampling was initiated with the beginning of treatment and analytical results for trichloroethene (TCE), trichlorethane (TCA) and PCE (Table 1) indicate that off-gas emissions were well below the 15 pounds per day permit exception requirement [Ohio Administrative Code (OAC) 3745-31-03, Paragraph D]. PCE and TCE were monitored throughout the treatment process.

TABLE 1
Results for Initial Gas Sample[1] Collected on November 18, 2003

Analyte	ppmv[2]	μg/L[3]	pounds/day[4]
TCE	1.98	10.6	0.008
TCA	11	60	0.043
PCE	12.5	85	0.061

[1] The highest result from the 1st 24 hours was used, as it represents the maximum potential concentration and the maximum estimated pounds per day discharged.

[2] Parts per million by volume $= (L_{TCE}/L_{gas})*10^6$.

[3] Micrograms per liter = ppmv*P*MW/RT
P = 1 atm, MW = molecular weight, T = 298 K, R = 0.082 L atm/mol K

[4] Pounds per day = μg/L*227 L/min*60 min*24 hrs*(1 lb/454000000 μg)
227 L/min corresponds to the gas flow rate of 8 ft^3/min

Additional information about the initial sampling of this soil pile can be found in Variances 11 and 12 of the PSP for Investigation of Soil Staged in Quonset Hut No. 1 (DOE 2002b). The Verification Report for the Removal of Tetrachloroethene from a Portion of Contaminated Soil Obtained from the Fire Training Facility, Remediation Area 6 (DOE 2004) was sent to both the EPA and OEPA on June 21, 2004. After receiving approval, part of the pile was removed and placed in the OSDF. Once this had been done, the remaining pile was reconfigured. Variance 13 (PSP for Investigating Soil Staged in Quonset Hut No. 1) was written to sample the remaining pile (Figure 2).

FIGURE 2
QUONSET HUT #1 SOIL PILE

APPROXIMATE SIZE AND LOCATION WITH QUADRANT DIVISIONS FOR SAMPLING
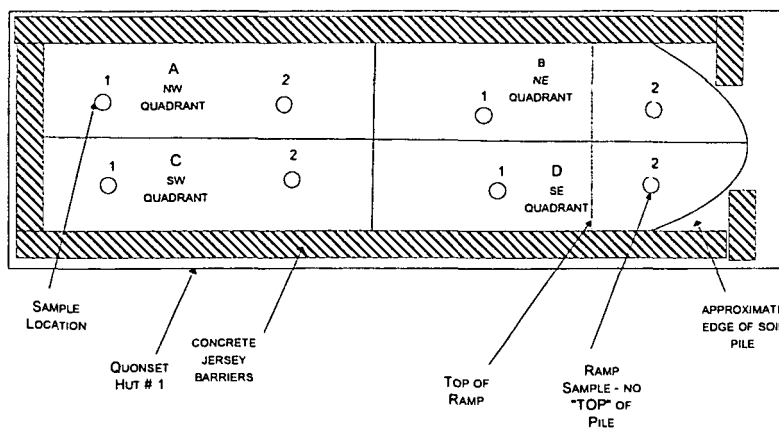
DRAWING NOT TO SCALE

On July 27 and 28, 2004, 23 samples were collected from 8 boring locations (Figure 2) under Variance 13 (PSP for Investigating Soil Staged in Quonset Hut No. 1) for toxicity characteristic leachate procedure (TCLP) PCE analysis. All results from the TCLP analyses (Table 2) are below regulatory levels, indicating that the toxicity characteristic for PCE has been removed from the soil.

TABLE 2	
TCLP Results for Soil Samples Collected on May 19, 2004	
Sample ID[1]	PCE (µg/L)
QH-FTF2-A1-B-TL	55.9
QH-FTF2-A1-M-TL	25.0
QH-FTF2-A1-T-TL	17.2
QH-FTF2-A2-B-TL	76.6
QH-FTF2-A2-M-TL	131
QH-FTF2-A2-T-TL	59.2
QH-FTF2-B1-B-TL	113
QH-FTF2-B1-M-TL	273
QH-FTF2-B1-T-TL	76.8
QH-FTF2-B2-B-TL	83.6
QH-FTF2-B2-M-TL	37.7
QH-FTF2-C1-B-TL	29.9
QH-FTF2-C1-M-TL	2.74
QH-FTF2-C1-T-TL	30.6
QH-FTF2-C2-B-TL	158
QH-FTF2-C2-M-TL	23.9
QH-FTF2-C2-T-TL	54.4
QH-FTF2-D1-B-TL	149
QH-FTF2-D1-M-TL	122
QH-FTF2-D1-T-TL	682
QH-FTF2-D2-B-TL	319
QH-FTF2-D2-M-TL	158
QH-FTF2-D2-P-TL	83.2

[1] Boring locations shown on Figure 2. Last two letters are for sample depth (B=bottom, M=middle, T=top or P=biased PID sample) and analytical method (TL=volatiles by TCLP)

2.1 Statistical Analysis of TCLP Results

The PCE data distribution appeared to be skewed (non-symmetrical). So, a distribution test was performed to determine the underlying distribution. The Shapiro-Wilk test indicated that the data were not Normally distributed (a P-value = 0.0000014), but were Lognormal (P-value = 0.4462). Therefore, the calculated statistics were based on the lognormal assumption. The parameter estimate equations are presented in Appendix G of the SEP as well as in *Statistical Methods for Environmental Pollution Monitoring* (R. O. Gilbert, 1987) and The Lognormal Distribution (J. Aitchison and J. A. C. Brown, 1963). The calculations show that a sufficient number of samples were collected to statistically conclude that the toxicity characteristic has been removed for the soil pile (Figure 2: Quonset Hut #1 Soil Pile). Though not required to demonstrate successful treatment, the 95th percentile indicates that the soil is unlikely to contain PCE contamination zones exceeding the TCLP limit of 700 μg/L.

TABLE 3
Statistical Calculations for TCLP Results

Parameter	Result – PCE (μg/L)
No. samples	23
Estimated $\bar{x}$*	135
Estimated s^2*	49,537
Estimated s*	223
Estimated $s_{\bar{x}}$*	46.4
upper CI(90%)	221
RT	700
n	2
p_{95}	662

$\bar{x}$ = mean of measurements   CI = confidence interval
s^2 = variance of measurements   RT = regulatory threshold
s = standard deviation of measurements   n = calculated minimum number of samples to collect
$s_{\bar{x}}$ = standard error of the mean P_{95} = 95 percentile of the population
* = estimated based on the lognormal distribution

3.0 CONCLUSIONS

The passive treatment process implemented for the soil staged in Quonset Hut No. 1 removed sufficient PCE from the pile sampled to achieve passing results for the TCLP test (i.e., all results are below the TCLP limit). Statistical calculations demonstrate that a sufficient number of samples were collected and that the 95 percentile of the sample population is below the PCE toxicity threshold of 700 μg/L. As the toxicity characteristic for PCE has been demonstrably removed from the remainder of the pile (see Figure 2), this soil can be placed in the OSDF upon concurrence from EPA and OEPA that the treatment has been successful.

4.0 REFERENCES

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